Comparison of drift-fluid modeling with experimental observations at NAGDIS-II - studies on intermittent cycles

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Plasma dynamics in linear devices is often characterized by convective motion of coherent structures leading to intermittent expulsion of particles and energy in radial direction. We present global drift-fluid simulations for linear devices showing a similar behaviour and compare the findings with experimental observations of the NAGDIS-II device. For this purpose a detailed statistical analysis is undertaken demonstrating that the numerical results resemble to a large extent the dynamics in the NAGDIS-II environment.

The results are very dependent on the particular description of ion-neutral collisions, i.e. the neutral particle profiles, and the shape of the particle source entering the plasma, i.e. details of the cathode and the discharge region. The influence of these factors is discussed along certain numerical parameter scans. It is shown that variation of steepness of the radial particle source gives a continuous transition from stable plasma configurations to a highly intermittent regime. For the intermediate scenario an oscillatory cycle can be identified. Using the method of Proper Orthogonal Decomposition this cycle is discussed in detail to clarify the mechanisms driving the instabilities in the plasma column.

Also particular attention is paid to the impact of those intermittent processes on the plasma wall interaction at the target. The possibility of strong changes in the neutral dynamics close to the target are adressed by consideration of various dominant processes and their modifications in the presence of strong fluctuations of plasma parameters.